R & D CATALOG FORM

DATE 26 January 1966

25X1

1. PROJECT TITLE/CODE NAME
Automatic Target Recognition Program

2. SHORT PROJECT DESCRIPTION
A Government sponsored long range R&D program to develop automated target recognition devices to aid image interpreters.

5. CLASS OF CONTRACTOR
Industrial R&D; Manufacturer

6. TYPE OF CONTRACT
CPFF

7. FUNDS
FY 19 $

8. REQUISITION NO.

9. BUDGET PROJECT NO.
NP-AT-O

25X1

FY 19 66

FY 19 67

10. EFFECTIVE CONTRACT DATE *(Begin - end)*
April 1966 - January 1967

11. SECURITY CLASS.
A.A. - Secret
T. - Unclassified
W. - Secret

12. RESPONSIBLE DIRECTORATE/OFFICE/PROJECT OFFICER TELEPHONE EXTENSION

25X1

DDI/NPIC/P&DS/

13. REQUIREMENT/AUTHORITY
Rapidly increasing acquisition of reconnaissance materials will demand vastly accelerated imagery exploitation processes. A program to develop automated inter-pretation systems to aid human interpreters, is required for NPIC.

14. TYPE OF WORK TO BE DONE

Applied Research

15. CATEGORIES OF EFFORT

MAJOR CATEGORY	SUB-CATEGORIES
Automatic Target Recognition	Computers
	Pattern Recognition
	Optical Filtering
	Scanning

16. END ITEM OR SERVICES FROM THIS CONTRACT/IMPROVEMENT OVER CURRENT SYSTEM, EQUIPMENT, ETC.
Delivery of specific, detailed designs and recommendations for components and sub-systems of the ultimate ATR system. These designs will be based on laboratory research, breadboarding, and evaluation of several potential ATR techniques during this first contracted phase. Implications and expected (Cont'd)

17. SUPPORTING OR RELATED CONTRACTS *(Agency & Other)*/**COORDINATION**
This Automatic Target Recognition Program is to be awarded as a prime contract which will incorporate a number of sub-contracts, associate contracts, and consultant contracts with other companies and individuals who are prominent in ATR research and development. A strong stipulation in the prime contract is (Cont'd)

18. DESCRIPTION OF INTELLIGENCE REQUIREMENT AND DETAILED TECHNICAL DESCRIPTION OF PROJECT *(Continue on additional page if required)*
The requirement for the development of automated image recognition systems is based upon the following predicted trends in reconnaissance and intelligence operations: (a) the acquisition rate, hence the volume, of operational imagery will continue to increase; (b) the information content per unit area of imagery continues to increase; (c) there are increasing requirements from intelligence analysts for information to be derived from imagery, both in variety and degree of detail; (d) the types of imagery will become more complex with the use of (Cont'd)

19. APPROVED BY AND DATE

OFFICE	DEPUTY DIRECTOR	DDCI

FORM 11-64 **2338**

GROUP 1
Excluded from automatic downgrading and declassification

(1-13)

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16.   results of the long range program (5 years) are outlined in
paragraph 18, below.

17.   that all other significant ATR work in the country will be
scrutinized and evaluated for potential usefulness to this program
and to avoid duplicative effort.

18.   color, infrared, radar, etc; (e) the allowable time to extract
certain types of information from imagery will decrease; (f) it is
a long and uncertain process to recruit, train, and retain the very
large number of interpreters which would be required to fully satisfy
these future conditions by entirely 'manual' techniques. It is
therefore incumbent upon the Government to develop automated image
recognition systems to aid the fully qualified interpreter in
performing some of his less complicated tasks. This, in turn, will
allow the interpreter to concentrate on the more complex interpretative
problems.

     The types of exploitation tasks which are now considered to be
amenable to automation include the following: (a) screening of
large volumes of imagery to separate 'sterile' portions of the film
from those containing possible targets of interest to the interpreter;
(b) classification of targets into broad type-categories; (c) re-scanning
of large volumes of previous coverage to search for one-type of target
of known configuration; (d) change detection on multiple coverage of
targets; (e) automatic recognition and correlation of map area to image
area in scanning operations; (f) automatic inventory of similar
objects within an image field.

     The feasibility of machine recognition of targets on aerial
photography has been demonstrated. It has been demonstrated by
various electro/optical/digital techniques, several of which have been
hardware implemented in crude prototype systems. Some of the more
promising ATR developmental systems are; the Tactical Target Recognizer
for the Army; the Natural Image Computer for GIMRADA; the Automatic
Target Recognition Device for RADC; and the Minos II by Stanford for
Ft. Monmouth. All of the systems developed to date satisfy some of
the required objectives, but all have serious deficiencies when
related to the ultimate operational requirements. These are:
(a) excessive processing time per unit area of film (the bandwidth
limit); (b) the resolution and dynamic ranges are too low; (c) versa-
tility not adequate for the many variables of target images;
(d) recognition accuracies need to be improved. These deficiencies
are considered to be the major problems to be solved in the proposed
ATR program. There now appears to be considerable promise that the
development of ATR systems can be realized which will overcome most
of these deficiencies.

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18. The configuration of the ultimate ATR system, or even the sub-
systems, is unknown at this point. The purpose of the initial
contracted effort will be investigation of several sub-system tech-
niques, laboratory breadboarding of the most promising sub-systems
and thorough evaluation of their potential. As a result of this
initial effort, a fairly firm system configuration can then be
designed. Our knowledge at this date indicates that there probably
will be four functional sub-systems: an input sub-system; an image
feature extraction sub-system; a decision-making and memory sub-system
(computer); and an interpretation display and control console. A
conceptual diagram of an ATR system is shown below.
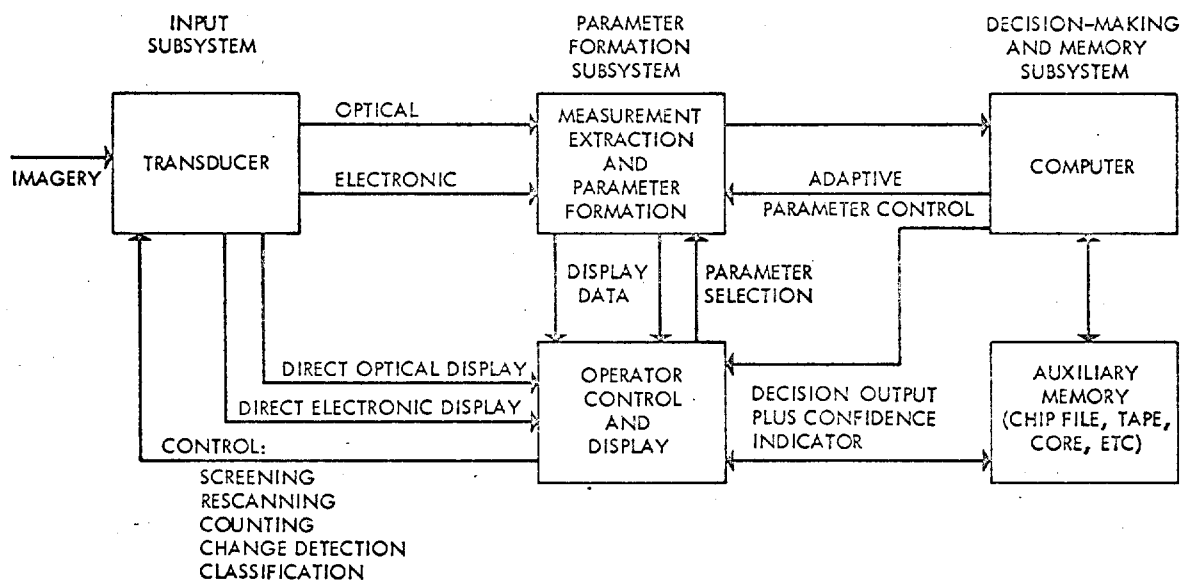
CONCEPTUAL BLOCK DIAGRAM OF AN AUTOMATIC TARGET RECOGNITION SYSTEM

        Of the fifteen proposals received for this program, [   ]
[   ] proposal was clearly the most promising techni-
cally, and proposed the most definitive program plan, organization,
and management. [   ] would
be the prime contractor with [   ] as the leading
sub-contractor. Other proposed sub-contractors are: [
                                                      ]
[   ] These companies represent a good national
cross-section of ATR talent and experience. The first phase of
this program would be a concentrated and concerted nine-month
effort by all the companies concerned and would encompass the following
major tasks:

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18. (a) Problem definition to determine, more specifically, the
          priority of tasks toward which an ATR system should be
          initially designed; and to define NPIC requirements for
          processing time, accuracy, resolution, types of targets, etc.

     (b) Evaluation of existing techniques for their potential
          application to NPIC requirements of the ultimate system
          (as determined above)

     (c) Study and evaluation of human factors which might be
          involved in an ATR system. These include: man-machine
          interface factors; types of display and control; and
          P.I. confidence factors with relation to machine decisions

     (d) Preliminary sub-system design and breadboard testing of
          potential sub-systems

     (e) Sub-system and system specifications

     (f) Formulation of a detailed long range development program.

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